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ABSTRACT

The purpose of this study was to conduct formative and summative evaluation for Computer Integrated Instruction (CII), an alternative use of computer-assisted instruction (CAI). The non-equivalent control group, pretest-posttest design was implemented with the class as the unit of analysis. Several of the instruments were adopted from existing CAI evaluation studies, while some had to be developed specifically for this study. The findings were (1) that the teachers were reluctant users of the CII materials and (2) that there was a significant difference for mathematics achievement favoring the control group. The evaluator suggests the following components be included in preservice training for teachers: (1) CII role-playing activities, (2) evaluation of CII software, and (3) computer literacy instruction. (Author/MP)

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PAPER PRESENTED AT

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A FORMATIVE AND SUMMATIVE EVALUATION OF COMPUTER INTEGRATED INSTRUCTION

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EVALUATION OF COMPUTER INSTRUCTION

ABSTRACT

The purpose of this study was to conduct formative and summative evaluation for Computer Integrated Instruction (CII), an alternative use of CAI. The Non-Equivalent Control Group, Pretest-Posttest Design was implemented with the class as the unit of analysis. Several of the instruments were adopted from existing computer-assisted instruction (CAI) evaluation studies, while some had to be developed specifically for this study. The findings were (1) that the teachers were reluctant users of the CII materials and (2) that there was a significant difference for mathematics achievement favoring the control group. The evaluator suggests the following components be included in preservice training for teachers: (1) CII role-playing activities, (2) evaluation of CII software, and (3) computer literacy instruction.

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A FORMATIVE AND SUMMATIVE EVALUATION OF COMPUTER INTEGRATED INSTRUCTION

Problem

Many researchers (Muznieks, 1977; Romaniuk, 1978; Springer, 1973) are concerned with the use of computer assisted instruction (CAI) that has not been adequately tested for classroom use. Studies that bridge the gap between the potential use of the microcomputer as an instructional tool and the effectiveness of specific instructional packages need to be undertaken.

The purpose of this research study was to conduct formative and summative evaluation of a State of Florida Title IV-C grant for CAI research awarded to the Secondary Mathematics Department of the Pinellas County School District.

The developers proposed a unique alternative for the microcomputer as an instructional tool. It integrated the microcomputer into the conventional classroom in conjunction with the teacher's own teaching style. That is, the teacher controlled the pace and parameters of the program. One machine was required per classroom, and viewing was on a 19-inch screen. Interaction and opportunities for discussion were intended for

total class presentation. The microcomputer was not used for every lesson but only where it complemented rather than duplicated instruction by the teacher or texts. Therefore, instead of traditional usage of the term CAI, the project used computer integrated instruction (CII).

Procedures

Formative

The intent of the formative evaluation was to collect descriptive data from students and teachers to improve the CII. The student data source consisted of students enrolled in all five Algebra II classes at a high school where CII was implemented. The teacher data source consisted of the two Algebra II teachers.

Both teachers and students evaluated CII software. Evaluation forms were completed by both teachers and students after each program's use. Observations were conducted every other week by the evaluator to describe and rate CII usage. Telephone interviews were scheduled for non-interview weeks to probe for implementation problems and to communicate them to the project coordinator. Teacher retrospective interviews were held towards the end of the evaluation period to collect suggestions for future use. Student interviews were conducted every other week during observation visits. Their purpose was to gather feedback on student perceived problems. A questionnaire to ascertain teacher concerns about using CII was administered both to the two teachers using the innovation and to those teachers targeted as next year's users. A teacher interview to rate the level of use was conducted at the end of the evaluation period with the two treatment teachers. Also, at this time students were given a survey on

attitudes toward CII.

The evaluator was in communication with the project coordinator throughout the implementation phase for county level decisions made that affected the project. All feedback was analyzed and changes implemented when appropriate to improve the project for current and future use.

To obtain information necessary to both describe the use of CII in the classroom and to evaluate the perceived effectiveness of its use, a variety of instruments were needed. Several of the instruments were adoped from existing CAI evaluation instruments, while some had to be developed specifically for this study.

Summative

The purpose of the summative evaluation was to determine the effects of CII on student Algebra II achievement, computer awareness, and attitudes toward mathematics and the instructional setting in comparison to non-CII instruction. This component of the evaluation study was viewed as product evaluation of CII.

The data source consisted of all students enrolled in Algebra II at the treatment and control schools. Each group contained between 120 and 150 subjects. All classes in both groups used the same text (Alegbra Two With Trigonometry, (Coxford, Lankford, Payne, & Zamboni, 1977) for study and assignments. All teachers had the same set of county objectives, and all computer programs were written to provide instruction for these objectives specifically. In addition to teacher and text developed lessons, the treatment group was given the CII which performed simulations

and calculations with speed beyond a teacher's capability. Also, many of the programs were recreational and were not included in the control group's classroom experiences. Teachers of the treatment classes were also freed from the typical time schedule if they felt using the CII materials was time consuming. Teachers of the treatment group were also encouraged to explain algebraic concepts of the CII lessons when different from the text.

All questions comparing the treatment and control groups' pre-program and post-program differences used the class as the level of analysis. Significance of pretest differences between treatment and control groups were determined by multiple t-test while posttest differences were determined by trait treatment interaction in which pretest algebra achievement served as the independent variable.

The Non-Equivalent Control Group, Pretest-Posttest Design was implemented. It was chosen because the two groups, control and experimental, were not formed by random assignment. To establish that the two schools were comparable, a t-test was performed on the previous year's PSAT mean scores. These tests come the closest to including primarily Algebra II students. In addition, pretests were administered to compare algebra achievement, attitudes toward mathematics, and attitudes toward the instructional setting between the two groups.

Results and Discussion

Unanticipated problems developed that decreased the amount of CII intended for the experimental group. The problems encountered were: (a) teacher decisions not to use CII materials as prescribed, and (b) hardware problems. This naturally meant that students in the experimental group did not receive the amount of CII intended by the developers.

Formative

The results of the formative evaluation contained the following:

1. Teachers suggested CII be used with small groups of students for drill and practice instead of total class presentation for developmental work. This is explainable in light of the teacher's planning needs. Without adequate preparation (program previewing), teachers were not comfortable adapting their teaching of new algebraic concepts to the different discovery methods of the CII programs. Instead, it was easier for the teachers to use the CII as practice to reinforce their own traditional (lecture) development.

2. Teachers were reluctant to use the CII materials. Reasons for this can be found in the literature in reference to implementing educational innovations. The reasons given are: (a) inadequate teacher training (Bakin & Alkin, 1973; Clower, 1981; DeVault & Chapin, 1981; Hall, 1981; Loukes, Newlove & Hall, 1978; MECC, 1981); and (b) the risks of innovation use outweigh the benefits of traditional instruction (Anderson, 1981; Devault & Chapin, 1981; Fey, 1981; House, 1974).

3. Student attitudes were neutral toward CII at the end of the evaluation period. The predominance of neutral responses is supported by the low utilization of CII for total class instruction and individual student use.

Summative

The results of the summative evaluation contained the following:

1. A significant difference at the .05 level was found for algebra achievement favoring the control group. This finding is consistent with

CAI achievement findings in the literature. Many researchers cite results in which the control group either outperformed the experimental groups or did as well (Daughdrill, 1978; Hoffman, 1971; Jhin, 1971; Katz 1971; Mitzel Hall, Suydam, Jansson & Igo, 1971; Payne, 1979; Robitaille, Sherrill & Kaufman, 1974; Ronan, 1971; Saunders, 1978). The evaluator believed that the frequency of CII was too low to cause a relationship in this study. For this reason, the evaluator examined the posttest class means for all classes, treatment and control. It is important to note that the control group class means differed by teacher assignment. The means of one teacher's classes were comparable to the class means in the experimental group. However, the means of the second teacher's classes were 2 to 6 points higher than the other class means, experimental or control. The evaluator interpreted the results in terms of teacher effects rather than treatment effects.

2. Results of the study regarding attitudes toward mathematics and the instructional setting showed no significant differences at the .05 level. These results were expected since CII was used too infrequently to infer attitudinal effects. These non-significant results were also consistent with those CAI attitude findings in the literature (Beck, 1979; DeBlassio, 1978; Lippold, 1979; Mitzel et al., 1971; Saunders, 1978).

3. Computer awareness mean scores by classes showed gains were not significant. The unanticipated low use of CII, especially the limited individual student use, explains the non-significance of the mean score gains across classes.

Recommendations

Both this study and those contained in the literature concerning educational innovations, make the connection between the quality of preservice training and the success of innovation use. The evaluator suggests the following components be included in preservice training for teachers: (a) CII role playing activities, (b) evaluation of CII software, and (c) computer literacy instruction.

The limited viewing provided by the 19 inch video monitors was a negative factor of the Pinellas Project. The full impact of CII could not be experienced with this limitation. Considering the rapid technological advances and the requirement of only one microcomputer per classroom, the evaluator recommends investing in larger screens rather than more microcomputers.

The procedural recommendations of this study include the following: (a) evaluation studies of CII or CAI innovations use both formative and summative designs, and (b) summative designs use experimental controls traditionally recommended (random assignment and each teacher instructs both a treatment and a control class).

References

Anderson, R. E. The Minnesota Educational Computing Consortium project on computer literacy instructional modules (CLIM). Paper presented at the National Educational Computing Conference, St. Paul, MN, June 1981.

Baker, E. L., & Alkin, M. C. Formative evaluation of instructional development. AV Communication Review, Winter 1973, 21(4), pp. 389-418.

Beck, J. J. An analysis of student attitude toward computer-assisted instruction in Nebraska public high schools (Doctoral dissertation, University of Michigan, 1979). Dissertation Abstracts International, 1979, 40, 3336-A.

Clower, K. Introducing technology is as simple as boiling water. Electronic Education, November 1981, pp. 22-29.

Coxford, A. E., Lankford, F. G., Payne, J. N., & Zamboni, F. F. Algebra II with trigonometry (3rd ed.). New York: Harcourt Brace Jovanovich, 1977.

Daughdrill, R. W. A comparative study of the effectiveness of computer-assisted instruction in college algebra (Doctoral dissertation, University of Michigan, 1978). Dissertation Abstracts International, 1978, 39, 3431-A.

DeBlassio, J. K. Student characteristics associated with attitudes toward using a computer in selected high school mathematics courses (Doctoral dissertation, University of Michigan, 1978). Dissertation Abstracts International, 1979, 40, 723-A.

DeVault, M. V., & Chapin, J. D. The teacher factor in the supply and demand curve for technology in the schools. Educational Technology, February 1981, pp.

Fey, J. T. Mathematics teaching today: Perspectives from three national surveys. Reston, VA: National Council of Teachers of Mathematics, 1981.

Hoffman, I. J. Effects of computer application on generalization skills and achievement in a second year algebra course (Doctoral dissertation, University of Michigan, 1971). Dissertation Abstracts International, 1971, 32, 2856-A.

House, E. R. The politics of educational innovation. Berkeley, CA: McCutchan Publishing Corporation, 1974.

Jhin, K. R. A statistical comparison of the effectiveness of non-tutorial computer-aided instruction and conventional teaching of algebra (Doctoral dissertation, University of Michigan, 1971). Dissertation Abstracts International, 1971, 32, 5734-B.

Lippold, G. A. The relationship of personalization, encouragement, and humor to student attitudes and posttest performance on a computer-assisted instructional program (Doctoral dissertation, University of Michigan, 1977). Dissertation Abstracts International, 1978, 38, 4690-A.

Loukes, S. F., Newlove, B. H., & Hall, G. E. Measuring levels of use of the innovation: A manual for trainers, interviewers, and raters. Austin, TX: University of Texas, 1975.

Minnesota Educational Computing Consortium. Highlight report: A study of computer use and literacy in science education. St. Paul, MN, August 1980.

Mitzel, H. E., Hall, K., Suydam, M., Jansson, L. C., & Igo, R. V. A commonwealth consortium to develop, implement and evaluate a pilot program of computer-assisted instruction for urban high schools, final report. University Park, PA: Pennsylvania State University, 1971. (ERIC Document Reproduction Service No. ED 059 604)

Muznieks, V. J. Procurement policy in CAI systems. Illinois Series in Educational Application of Computers, No. 26, February 1972. (ERIC Document Reproduction Service No. ED 138 292)

Payne, C. I. The effects of computer mathematics instruction on achievement, problem solving, and attitudes in a public school (Doctoral dissertation, University of Michigan, 1979). Dissertation Abstracts International, 1980, 40, 3850-A.

Robitaille, D. F., Sherrill, J. M., & Kaufman, D. M. The effect of computer utilization of the achievement and attitudes of grade nine mathematics students. Journal for Research in Mathematics Education, 1977, 1, 26-32.

Romaniuk, E. W. Problems in research course adequacy, March 1978. (ERIC Document Reproduction Service No. ED 156 155)

Ronan, F. D. A study of the effectiveness of a computer when used as a teaching and learning tool in high school mathematics (Doctoral dissertation, University of Michigan, 1971-1972). Dissertation Abstracts International, 1972, vol, 1264-1265-A.

Saunders, J. The effects of using computer-enhanced resource materials on achievement and attitudes in second year algebra (Doctoral dissertation, University of Michigan, 1978). Dissertation Abstracts International, 1978.

Springer, G. Report on the conference on the K-12 mathematics curriculum. Snowmass, CO, 1973. (ERIC Document Reproduction Service No. ED 081 643)